

We claim:

1. A wine quality sensor, comprising:

means for sensing data indicative of wine quality; and
means for measuring and quantifying said data.

2. The wine quality sensor of claim 1, wherein said means for sensing data comprises a sensor package having at least one sensor for sensing said data.

3. The wine quality sensor of claim 2, wherein said sensor package is configured for integration into a wine bottle.

4. The wine quality sensor of claim 1, wherein said means for measuring and quantifying said data comprises a measuring package.

5. The wine quality sensor of claim 3, wherein said wine bottle is formed of glass, wherein said bottle may be sealed with a seal after it is filled with wine, wherein said sensor package is integrated into said seal with a sensor integration configuration selected from the group consisting of (i) integration of said sensor package within said

5 glass, (ii) integration of said sensor package within said seal and (iii) integration of said sensor package between said seal and said glass.

6. The wine quality sensor of claim 5, wherein said seal is selected from the group consisting of a cork, plastics, rubbers, resins, waxes, cellulose, cellulose derivatives, synthetic organic compounds, silicones, silicone derivatives, epoxies and glues.

7. The wine quality sensor of claim 1, wherein said data is selected from the group consisting of alcohol, sugar, pH, dissolved oxygen, an optical transmission spectrum, an optical fluorescence spectrum, an optical scattering coefficient, SO₂, and phenol.

8. The wine quality sensor of claim 4, wherein said measuring package comprises means for displaying said at least one wine quality value.

9. The wine quality sensor of claim 8, wherein the displaying means comprises an LCD display.

10. The wine quality sensor of claim 8, wherein said measuring package is configured for portable handheld operation.

microcomputer

~~11. The wine quality sensor of claim 3, wherein said wine bottle is formed of~~

12. The wine quality sensor of claim 11, wherein said bottle comprises a hole

13. The wine quality sensor of claim 2, wherein said at least one sensor is

14. The wine quality sensor of claim 2, wherein said at least one sensor

15. The wine quality sensor of claim 14, wherein said at least one sensor

16. The wine quality sensor of claim 14, wherein said data comprises an

17. The wine quality sensor of claim 16, wherein said means for measuring

23. The wine quality sensor of claim 17, further comprising means for measuring scattered light.

24. The wine quality sensor of claim 2, wherein said means for measuring said data comprises a microprocessor that reads said at least one sensor.

25. The wine quality sensor of claim 2, further comprising a housing that fits around and encloses said measuring means, wherein said measuring means comprises a measuring package for measuring said data, wherein said measuring package comprises:

at least one light source to provide light to said sensor package;

at least one fiber optic for transmitting light from said at least one light source to said sensor package and for receiving light from said sensor package;

at least one detector for detecting said light;

means for providing power to said at least one sensor;

an LCD display to display menus and said data; and

a microprocessor to control said wine quality sensor.

26. The wine quality sensor of claim 25, wherein said at least one light source comprises a broadband light source.

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27. The wine quality sensor of claim 25, wherein said at least one detector is selected from the group consisting of a linear CCD coupled to a grating spectrometer and a filtered optical diode to enable the fluorescence and/or absorption spectrum of the wine to be measured over a wavelength region extending from 300-1300 nm and a set of individual filtered optical diodes that measure fluorescence and/or absorption characteristics at discrete wavelengths.

28. The wine quality sensor of claim 25, wherein said powering means comprises a battery.

~~29.~~ The wine quality sensor of claim 25, wherein said microprocessor includes an analog to digital converter selected from the group consisting of an integrated analog to digital converter and a separate analog to digital converter IC.

~~30.~~ The integrated wine quality sensor of claim 25, further comprising an external computer, further comprising means for connecting said microprocessor to said external computer, wherein said data can be downloaded into said external computer where it can be stored for future comparison.

31. The wine quality sensor of claim 2, wherein said sensor package comprises a cover selected from the group consisting of a hinged cover and a cap, wherein said cover protects said sensor package.

32. The wine quality sensor of claim 31, wherein said cover includes a sensor number for identification of said sensor and for obtaining calibration data.

33. The wine quality sensor of claim 1, wherein said data is selected from the group consisting of galacturonic acid, gums - polysaccharides of arabinose and galactose; tartaric acid, malic acid, citric acid, succinic acid, lactic acid, acetic acid, potassium bitartrate, formic, Yair Margalit, Pacid, oxalic acid, pyruvic acid, butyric acid, iso-butyric acid, hexanoic acid, octanoic acid, a-Ketoglutaric acid, ethanol, methanol, methyl ester, n-propanol, isopropanol, n-butanol, isobutanol, n-amyl alcohol, 3-methylbutanol, 2-methylbutanol, n-hexanol, 2-phenylethanol, polyalcohols (polyols), 2,3-butandiol, glycerol, erythritol, xylitol, arabitol (also called arabinitol), mannitol, acetaldehyde, acetoin and diacetyl, acetate, butyrate, oxanoate and other esters, ethyl acetate, ethyl formate, propyl acetate, isopropyl acetate, isobutyl acetate, isoamyl acetate, phenylethyl acetate, ethyl propionate, ethyl valerate, ethyl hexanoate (caproate), ethyl octanoate (caprylate), ethyl decanoate (caprate), ethyl lactate, ethyl succinate (acidic ester), methyl o-anthranilate, amino acids, diammonium phosphate, proteins, nitrates, amino acid esters, vitamins, biotin, choline, gallic acid, coumaric acid, caffeic acid, ferulic acid, catechin, epicatechin, galocatechin gallate, procyanidin (B1,

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B2, B3), catechin catechin gallate, hydroxycinnamic acid esters (coutaric, caftaric, fertaric), acids, glutathionyl caftaric acid, catechin+epicatechin, catechin-gallate, afzelechin, catechin, epicatechin, and gallocatechin, flavane (3,4) diol, flavonol-3, cyanidin, delphinidin, peonidin, petunidin, mallvidin, anthocyanins, glycosic, catechin, epicatechin, potassium, sodium, calcium, iron, lithium, magnesium, copper, lead, manganese, aluminum, zinc, rubidium, arsenic, nickel, anions, phosphate, sulfate, borates, silicates, halogens, fatty acids, boron, fluorine, silicon, phosphate, sulfate, chlorine, bromine, iodine, anions, sulfur dioxide, acetaldehyde-bisulfite (bound SO₂), fumaric acid, vinylbenzene, benzaldehyde, γ -nonalactone, ethyl phenylacetate, p-hydroxybenzoic acid, p-pyrocatechuic acid, gallic acid, vanillic acid, syringic acid, salicylic acid, o-pyrocatechuic acid, gentisic acid, cinnamic acid, cinnamic acid, p-coumaric acid, caffeic acid, ferulic acid, sinapic acid, coutaric acid, caftaric acid, fertaric acid, digallic acid, ellagic acid, flavonoids, afzelechin, catechin, gallocatechin, glycosides, tannins, flavylum ion, anthocyanins, pelargonidin, cyanidin, delphinidin, peonidin, petunidin, mallvidin, ethyl acetate, ethyl caproate, terpenoids, glycosides, pyrazines, phenolics, chlorogenic acid, methyl anthranilate, ethyl anthranilate, methyl salicylate, ethyl salicylate, 2-methoxymethyl benzoate, 2-methoxyethyl benzoate, ethyl trans-2-butenoate, ethyl trans-2-hexenoate, ethyl trans-2-octenoate, ethyl trans-2-decenoate, ethyl trans, trans-2,4 decadienoate, ethyl trans, cis-2,4 decadienoate, ethyl trans, trans, cis-2,4,7-decatrienoate, ethyl trans, cis-2,6-dodecadienoate, methyl 3-hydroxybutanoate, ethyl 3-hydroxybutanoate, ethyl 3-hydroxyhexanoate, damascenone, furaneol, methoxyfuraneol, ethyl 3-

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mercaptopropanoate, trans-2-hexen-1-ol, hydrogen disulfide, carbon disulfide, dimethyl disulfide, dimethyl sulfide, diethyl sulfide, diethyl disulfide, methanethiol, ethanethiol, dimethyl sulfoxide, methyl thiolacetate, ethyl thiolacetate, cis and trans-2-methylthiophan-3-ol, 5-[hydroxyethyl]-4-methylthiazole, thio aliphatic alcohols, methanionol, or 3-(methylthio)-propanol, polyphenoloxidases, laccase, chlorogenic acid, protocatechuic acid, glutathione,, 2-S-glutathionylcaftaric acid, acetaldehyde, 13C-Norisoprenoids, 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN), vitispirane, ellagic acid, lignins, gallic acid, aromatic aldehydes, vanillin, syringaldehyde, coniferyaldehyde, sinapaldehyde, γ lactones, cis- β -methyl- γ -lactone, trans- β -methyl- γ -lactone, maltol, cyclotene, ethoxylactone, furfural, furfuryl alcohol, Guaiacol, geosmin, anthocyanine-bisulfite, malvidin glucoside, quinones, tartaric acid, potassium bitartrate, calcium tartrate, fumaric acid, calcium carbonate, sorbic acid, ethyl sorbate, benzoic acid and sodium benzoate, diethyl dicarbonate (DEDC), dimethyl dicarbonate (DMDC), iron, copper, aluminum, hydrogen sulfide, mercaptan, diethyl sulfide, ethyl mercaptan, (1)pH, diacetyl, acetoin, 2,3-butandiol, 2-ethoxyhexa-3,5-diene, histamine, tyramine, putrescine, cadaverine, ethyl carbamate, urea and carbamyl phosphate.

34. A method for measuring wine quality, comprising:

sensing data indicative of wine quality; and

measuring and quantifying said data.

35. The method of claim 34, wherein the step of sensing data includes sensing data selected from the group consisting of an optical transmission spectrum, an optical fluorescence spectrum, an optical scattering coefficient, galacturonic acid, ^{bind now} (gums - polysaccharides of arabinose and galactose) tartaric acid, malic acid, citric acid, succinic acid, lactic acid, acetic acid, potassium bitartrate, formic, Yair Margalit, Pacid, oxalic acid, pyruvic acid, butyric acid, iso-butyric acid, hexanoic acid, octanoic acid, a-Ketoglutaric acid, ethanol, methanol, methyl ester, n-propanol, isopropanol, n-butanol, isobutanol, n-amyl alcohol, 3-methylbutanol, 2-methylbutanol, n-hexanol, 2-phenylethanol, polyalcohols (polyols), 2,3-butandiol, glycerol, erythritol, xylitol, arabitol (also called arabinitol), mannitol, acetaldehyde, acetoin and diacetyl, acetate, butyrate, oxanoate and other esters, ethyl acetate, ethyl formate, propyl acetate, isopropyl acetate, isobutyl acetate, isoamyl acetate, phenylethyl acetate, ethyl propionate, ethyl valerate, ethyl hexanoate (caproate), ethyl octanoate (caprylate), ethyl decanoate (caprate), ethyl lactate, ethyl succinate (acidic ester), methyl o-anthranilate, amino acids, diammonium phosphate, proteins, nitrates, amino acid esters, vitamins, biotin, choline, gallic acid, coumaric acid, caffeic acid, ferulic acid, catechin, epicatechin, gallic acid gallate, procyanidin (B1, B2, B3), catechin catechin gallate, [hydroxycinnamic acid esters (coumaric, caffeic, ferulic)], acids, glutathionyl caffeic acid, catechin+epicatechin, catechin-gallate, afzelechin, catechin, epicatechin, and gallic acid, flavane (3,4) diol, flavonol-3, cyanidin, delphinidin, peonidin, petunidin, malvidin, anthocyanins, glycoside, catechin, epicatechin, potassium, sodium, calcium, iron, lithium, magnesium, copper, lead, manganese, aluminum, zinc,

rubidium, arsenic, nickel, anions, phosphate, sulfate, borates, silicates, halogens, fatty
 acids, boron, fluorine, silicon, phosphate, sulfate, chlorine, bromine, iodine, anions,
 sulfur dioxide, acetaldehyde-bisulfite (bound SO₂), fumaric acid, vinylbenzene,
 benzaldehyde, γ -nonalactone, ethyl phenylacetate, p-hydroxybenzoic acid, p-
 5 pyrocatechuic acid, gallic acid, vanillic acid, syringic acid, salicylic acid, o-
 pyrocatechuic acid, gentisic acid, cinnamic acid, cinnamic acid, p-coumaric acid,
 caffeic acid, ferulic acid, sinapic acid, coumaric acid, caffeic acid, ferulic acid, digallic
 acid, ellagic acid, flavonoids, afzelechin, catechin, gallic acid, glycosides, tannins,
 flavylum ion, anthocyanins, pelargonidin, cyanidin, delphinidin, peonidin, petunidin,
 10 malvidin, ethyl acetate, ethyl caproate, terpenoids, glycosides, pyrazines, phenolics,
 chlorogenic acid, methyl anthranilate, ethyl anthranilate, methyl salicylate, ethyl
 salicylate, 2-methoxymethyl benzoate, 2-methoxyethyl benzoate, ethyl trans-2-
 butenoate, ethyl trans-2-hexenoate, ethyl trans-2-octenoate, ethyl trans-2-decenoate,
 ethyl trans, trans-2,4-decadienoate, ethyl trans, cis-2,4-decadienoate, ethyl trans, trans,
 15 cis-2,4,7-decatrienoate, ethyl trans, cis-2,6-dodecadienoate, methyl 3-
 hydroxybutanoate, ethyl 3-hydroxybutanoate, ethyl 3-hydroxyhexanoate,
 damascenone, furaneol, methoxyfuraneol, ethyl 3-mercaptopropanoate, trans-2-hexen-
 1-ol, hydrogen disulfide, carbon disulfide, dimethyl disulfide, dimethyl sulfide,
 diethyl sulfide, diethyl disulfide, methanethiol, ethanethiol, dimethyl sulfoxide,
 20 methyl thiolacetate, ethyl thiolacetate, cis and trans-2-methylthiophan-3-ol, 5-
 [hydroxyethyl]-4-methylthiazole, thio aliphatic alcohols, methanionol, or 3-
 (methylthio)-propanol, polyphenoloxidases, laccase, chlorogenic acid, protocatechuic

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36. The method of claim 34, further comprising displaying said data.

~~37.~~ The method of claim 34, wherein the step of sensing data includes

38. The method of claim 34, wherein the step of sensing data includes

39. The method of claim 34, wherein the step of sensing data includes sensing an absorption spectrum of the wine

40. The method of claim 33, wherein the step of sensing data includes measuring scattered light.

41. The method of claim 33, further comprising downloading said data to an external computer.

42. A wine cork quality sensor, comprising:
means for sensing data indicative of cork quality; and
means for measuring and quantifying said data.

43. The wine cork quality sensor of claim 42, wherein said means for sensing data comprises at least one sensor for directly monitoring at least one chemical factor within a cork indicative of cork spoilage.

44. The wine cork quality sensor of claim 43, wherein said at least one chemical factor is selected from the group consisting of 2,4,6-Trichloroanisole, o-Hydroxyanisole, 1-octen-3-one and 1-octen-3-ol, Trans-1,10-dimethyl-trans-9-decalol, 2-methylisoborneol and TCA (trichloroacetic acid).

45. A method for measuring wine cork quality, comprising:

sensing data indicative of cork quality; and
measuring and quantifying said data.

claim 45, which is a factor with

octen-3-one and 1-octen-3-ol, Trans-1,10-dimethyl-trans-9-decalol, 2-methylisoborneol and TCA (trichloroacetic acid).

[illegible]